

REMARKS

INTRODUCTION:

In accordance with the foregoing, claims 1-14 have been amended. Claims 1-14 are pending and under consideration. Claims 5-7, 12 and 13 are "objected to."

REJECTION UNDER 35 U.S.C. §112:

Claims 1-4, 8-11 and 14 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

It is respectfully submitted that the present amendments to the claims overcome the rejection.

Claims 1-4, 8-11 and 14 are rejected under 35 U.S.C. §112, first paragraph, as based on a disclosure, which is not enabling.

According to the Examiner, the Specification does not distinguish the difference between the prior art and the Applicant's invention. However, as set forth in the Specification, the hyperbolic curve optimizes the gap between a central portion "a" of the rotor and the gaps between the side portions "b" and the inner periphery of the stator. These factors are discussed, for example, in the present Specification, page 7, (last paragraph) to page 3 (third full paragraph).

In contrast, a conventional rotor has a circular outer periphery. Since the radius of the conventional curve is constant, the gaps "a" and "b" cannot both be optimized, since optimizing one of these gaps results in less than optimal position with respect to the other gap. These factors are discussed, for example, in the present Specification, page 2, (first full paragraph) to page 3 (line 2).

Accordingly, withdrawal of the rejection is requested.

REJECTION UNDER 35 U.S.C. §103:

Claims 1-4 are rejected under 35 U.S.C. §103(a) as being unpatentable over JP

02000350393 to Miyata and in further view of Abramowitz et al.

Independent claim 1 recites "a plurality of poles, where at least a part of an outer periphery of one pole of the rotor has a shape of a hyperbolic cosine curve in a cross section perpendicular to a central axis of the rotor." Support for this feature is found, for example, at page 6 (equation 1) and page 9 (equation 2) of the present Specification.

In an R coordinate system set to a rotor of one pole with r ranging from 22.5 to 22.5 , any curve $r(\theta)$ can be expressed by a combination of cosine functions and the sine functions according to the Fourier series. Thus, it is a matter of course that the hyperbolic cosine curve is expressed by the trigonometric function. Claim 1 recites the hyperbolic cosine curve for defining at least a part of the outer periphery of one pole of the rotor in an infinity of curves, and the hyperbolic cosine curve is not able to express an arbitrary curve. The advantage of adopting the hyperbolic cosine curve is described below. Thus, the hyperbolic cosine curve is selected from an infinite number of curves to have a specific advantage when defining the outer periphery of one pole of the rotor.

It is required for a synchronous motor to reduce a gap between a central portion of each pole of the rotor and an inner periphery of the stator in view of increasing an output torque, and to increase a gap between side portions of each pole of the rotor and the inner periphery of the stator in view of reducing the inductance, as described in detail in the "Description of Related Art" at pages 1-3 of the Specification.

In searching a mathematical function to meet the above both requirements, it is found that exponential function e^x shows a slight increase with X in a range smaller than zero, a gradual increase in the vicinity of zero and a sharp increase as X further increases. However, since the exponential function curve is not axisymmetric, it is not applicable to define the outer periphery of the rotor, but a curve of the hyperbolic cosine function including a sum of exponential function e^x and the exponential function e^{-x} is axisymmetric and thus is applicable to defining of the outer periphery of the rotor. The hyperbolic cosine curve inherits the features of the exponential function which is the basis of the hyperbolic cosine curve to show the gradual increase in the vicinity of $X=0$ and the sharp increase as X further increases to meet both of the above requirements for improving characteristics of the synchronous motor.

Thus, it would not have been obvious to define at least a part of the cross-sectional contour of one pole of the rotor by hyperbolic cosine curve to one of ordinary skill in the art from the prior art as shown by the Examiner.

Furthermore, the Examiner admits that Miyata does not teach or suggest the claimed hyperbolic curve. Instead, the Examiner relies upon Abramowitz as teaching this feature. The Examiner asserts that the motivation for this combination would have been to increase torque in a motor.

However, the references do not teach that this combination would increase torque, or provide any other advantage. Miyata teaches a motor having circular pole, similar to the conventional motor described in the Description of the Related art. However, the Examiner has not shown any teaching in this reference that a hyperbolic shape may be used to improve performance.

Similarly, Abramowitz is a mathematical text which teaches abstract mathematical relationships. However, this reference does not teach the application of these relationships to motors, or any other field. Therefore, this reference does not teach that these mathematical relationships may be used to increase torque, or achieve any other result in a motor.

The Examiner has simply taken a motor, and applied a mathematical function to the motor, without providing any specific incentive in the references for doing so. Thus, it is submitted that the Examiner's combination is a hindsight reconstruction of the claimed invention. Accordingly, withdrawal of the rejection is requested.

Claims 8-11 and 14 are rejected under 35 U.S.C. §103(a) as being unpatentable over Miyata and in further view of JP 406217478 to Nitta et al. and Abramowitz et al.

It is respectfully submitted that Nitta et al. does not overcome the above deficiencies in Miyata and Abramowitz, and is not relied upon by the Examiner to do so.

ALLOWABLE SUBJECT MATTER:

Claims 5, 6, 7, 12 and 13 are allowed. Claims 5, 6, 7, 12 and 13 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The claims are rewritten into independent form herein.

CONCLUSION:

There being no further outstanding objections or rejections, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited.

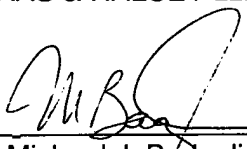
Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

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